UH-7-1

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INTEGRATION OF QUIETING TECHNOLOGY INTO NEW MANTRIP VEHICLES

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BUREAU OF MINES ★ UNITED STATES DEPARTMENT OF THE INTERIOR
Minerals Health and Safety Technology

product line in a cooperative engineering effort intended to demonstrate the viability of reducing noise levels on mining equipment.

The major noise sources BBN identified as common to most makes of portal buses are as follows:

- Wheel/rail interaction
- Drive motors
- Drive train
- Impacts between suspension members or between loosely bolted components.

The generated noise was transmitted to the passenger positions through airborne and structureborne paths; however, the overall noise was dominated by the structureborne contribution.

The noise-control treatments applied to the production-model portal bus on the current program included the following:

- Suspension Isolation

  The system components were isolated from the vehicle frame by inserting elastomeric materials between them. Specific treatment areas were trailing arm bushings and lock plates, coil spring end cups, and suspension arm lateral guide plates.

- Panel Damping

  Vibration-induced noise was reduced by replacing all large sheet metal panels (except the floor plates) with damped steel panels. The selected material was U. S. Steel's NEXDAMP-II. Essentially all the skin, roof, seat backs, interior panels, and motor enclosure were made from this material.

- Motor Enclosure

  Motor airborne noise was reduced by tight-fitting covers made from damped steel (NEXDAMP-II) and lined with sound-absorbing material (Owens Corning 703 or 705 fiberglass board). Motor structureborne noise was lowered by using elastomeric motor mounts (Barry G05-041).

- Drive Train

  The standard spur gears used in the traction drive system were replaced with helical gearsets to test their effect on drive train noise and vibration.

Results of these treatments are summarized in Table 1 and represented graphically in Figures 1 and 2. Appendix B is a detailed report discussing the effectiveness of treatments by comparing treated and untreated mantrips.

Table 1 NOISE TREATMENT EFFECTIVENESS*

Source	Untreated contribution (dBA)	Insertion Loss of Treatments (dB)						Treated contribution (dBA)
		IL_D: Damping	IL_S: Soft Suspension	IL_C: Tight Covers	IL_F: Fiberglass on Covers	IL_V: Motor Mounts	IL_H: Helical Gears	
L_{WR}: Wheel/Rail	91	4.2	4	-	-	-	-	82.8
L_M : Motor Airborne	82.5	-	-	5	3.5	-	-	74
L_M : Motor Structureborne	81.0	4.2	-	-	-	5	-	71.8
L_D : Drive Train	80	4.2	-	-	-	-	4.4	71.4

*At 12.8 mph and with a single motor/axle assembly

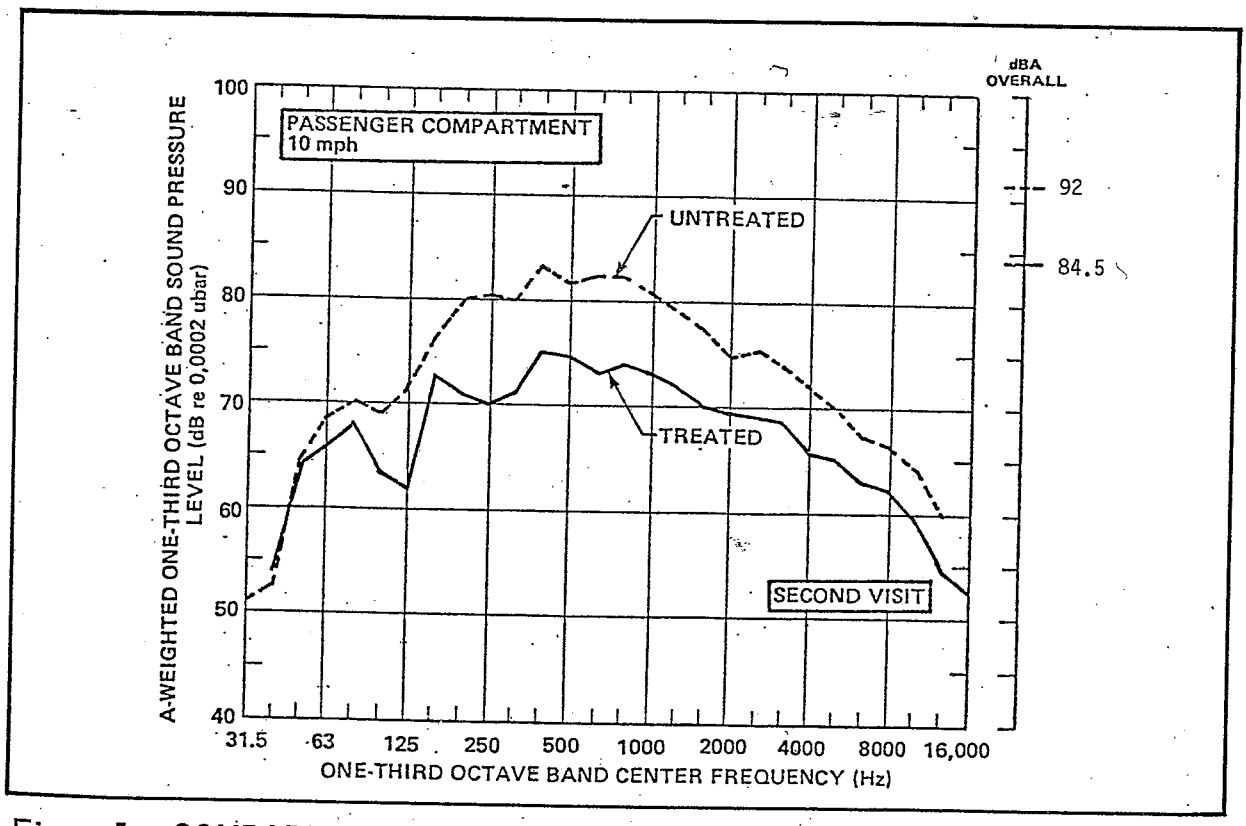

Figure 1 COMPARISON OF TREATED AND UNTREATED FMC MODEL MANTRIP, PASSENGER COMPARTMENT

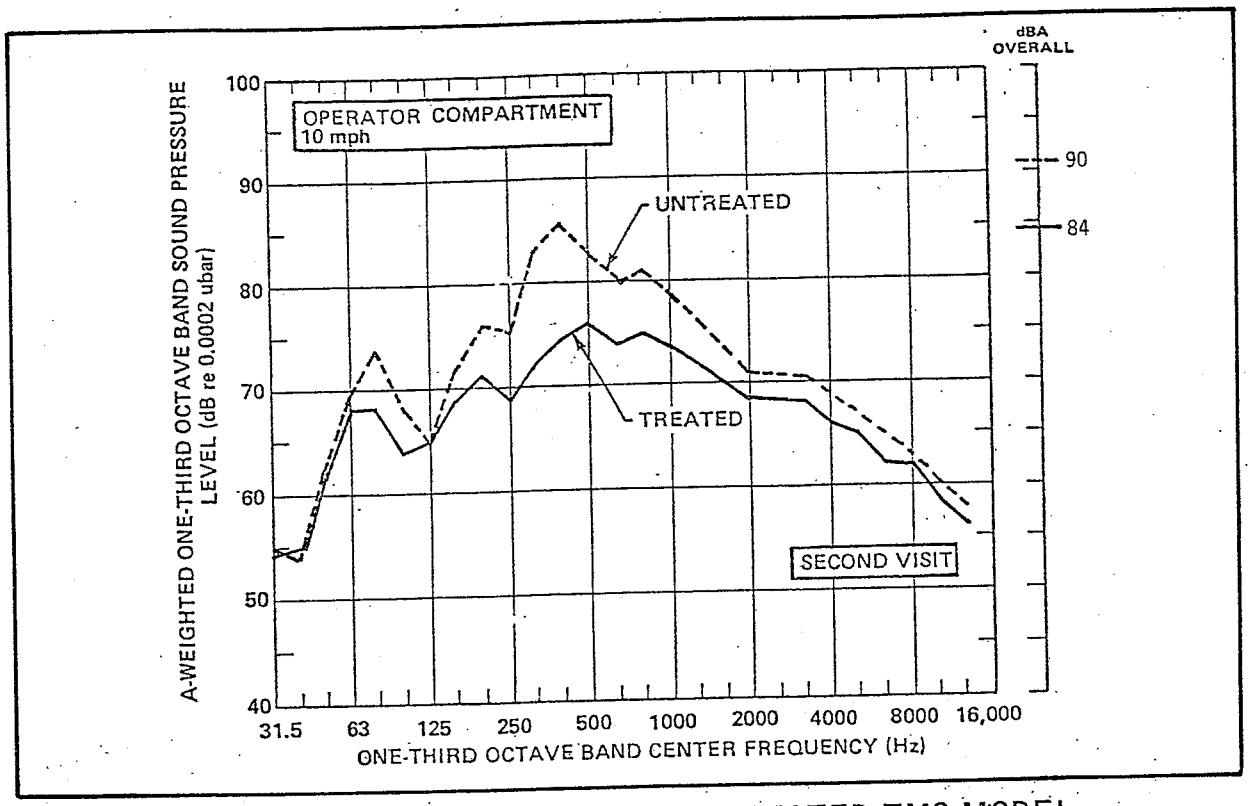

Figure 2 COMPARISON OF TREATED AND UNTREATED FMC MODEL MANTRIP, OPERATOR COMPARTMENT

Two important considerations prevailed as the treatments were being designed: marketability and durability. Noise-control materials and installation labor costs were to be limited by a target cost that was not to exceed 5 percent of the purchase price of an unmodified portal bus. Durability had to be demonstrated by successful operation of the bus in an underground coal mine. The cost and endurance objectives were met by the noise-reduction modifications.

The final program results were as follows:

- An FMC Model 2450-D8 portal bus was manufactured incorporating the noise-reduction treatments recommended by BBN engineers.
- Comparison testing revealed a 7.5-dBA reduction in noise level at the passenger's ear, with a maximum noise level of 84.5 dBA at 10 mph vehicle speed on straight and curved track in an underground coal mine.
- The suspension-isolation treatment virtually eliminated wheel/rail noise due to its "steerable axle" effect.
- Modification costs for materials and labor were estimated to be $1,305 (4.3 percent) of an unmodified portal bus purchase price in production quantities (September 1980 estimate).